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ACCEPTED MANUSCRIPT

1	Study of the vortex principle for improving the efficiency of an
2	exhaust ventilation system
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6	
7	Abstract
8	In both industrial and civil buildings, local exhaust ventilation systems are widely used in
9	pollutant control. The efficiency of such systems has an important influence on indoor air
10	quality and energy consumption. A tornado is a type of rotating vortex with strong suction
11	force that can lift heavy weights into the atmosphere. This paper presents a novel type of
12	artificial vortex exhaust device (AVED) using the principle of tornado-like vortex to improve
13	the efficiency of local exhaust system. The formation of a tornado-like vortex requires a
14	circular updraft fed by air possessing angular momentum with respect to the updraft center
15	axis. To understand the flow characteristics of AVED, the velocity distribution and pressure
16	distribution are investigated by varying the following parameters via experimental methods:
17	radius ratio, lifting ratio, control distances, velocity of the jets and flow rate of exhaust hood.
18	The experimental results indicate that increasing the velocity of the jets is beneficial to
19	forming vortex, and the appropriate range to form an optimal vortex of the radius ratio is 1 to
20	2, and that of the lifting ratio is 0.127 to 0.256. Compared to the ordinary canopy exhaust
21	hood, AVED has at least twice the control distance while only requiring less than half the flow
22	rate of the exhaust hood.

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